



The Environmental Scenario Generator

**Steve Lowe
SAIC**

August 27,
2003

Brief to ASNE In
ternal Meeting

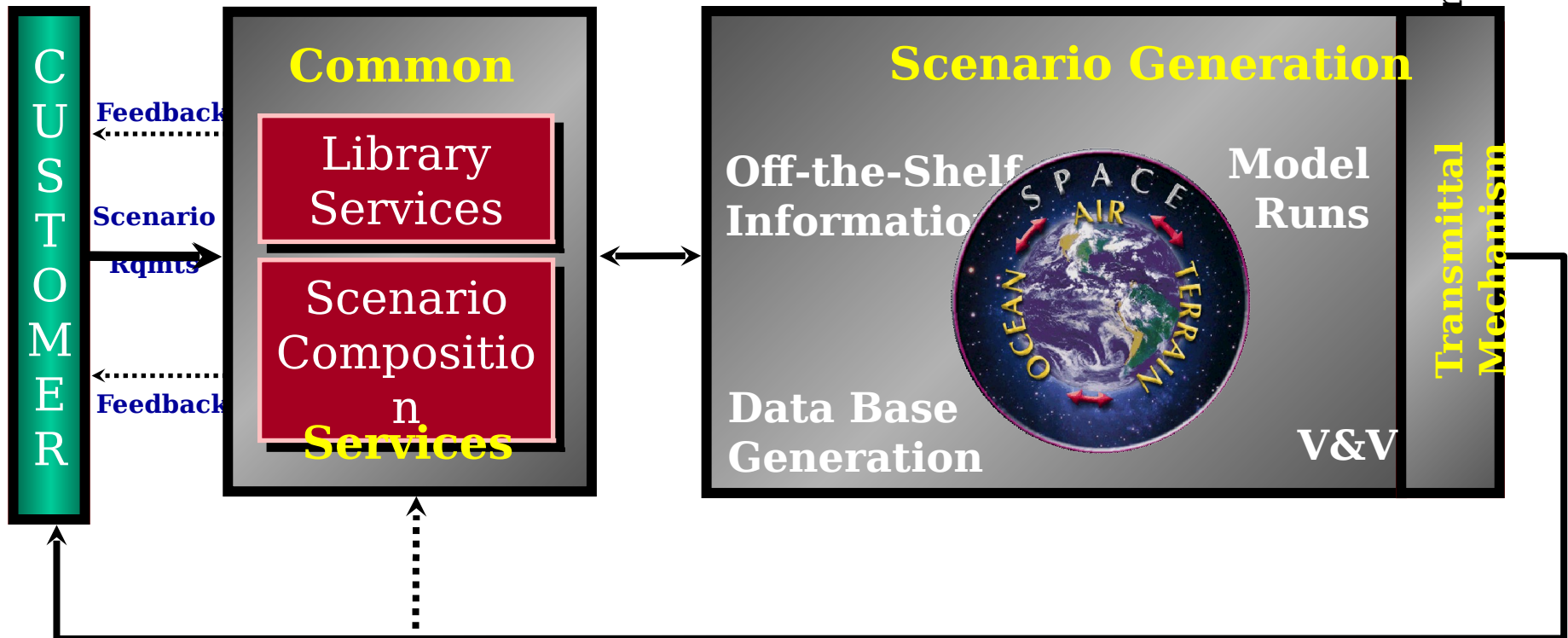
SPONSORED BY ...



Integrated Natural Environment Authoritative Representation

Process The Challenge

Create a physically consistent, cross-domain,
authoritative representation of the natural environment
that meets user requirements



ESG Functionality



Mapping of Customer Requirements to the best available off-the-shelf or custom-produced resources for M&S

Intelligent Searching for Meaningful Environmental Events

Inter-Domain Production

Operational System at AFCCC

<https://esgweb.afccc.af.mil/esg>

For Access Contact:

ASNE/MSEA or

esghelp@saic-ine.com

Coordination

Online Data Analysis of all

Resources

Application in

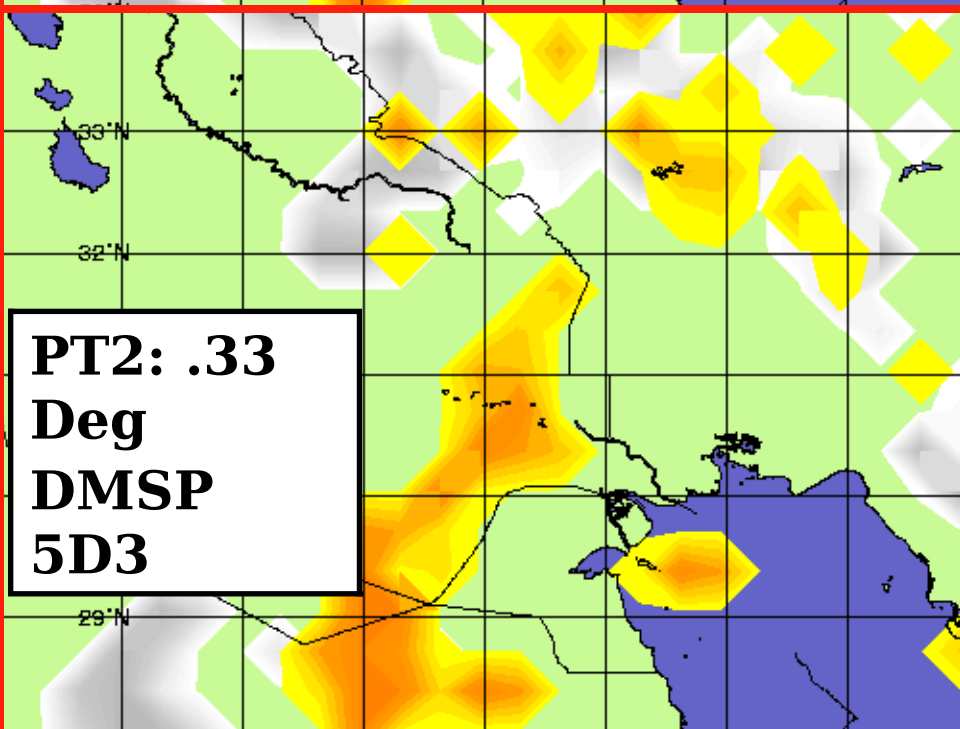
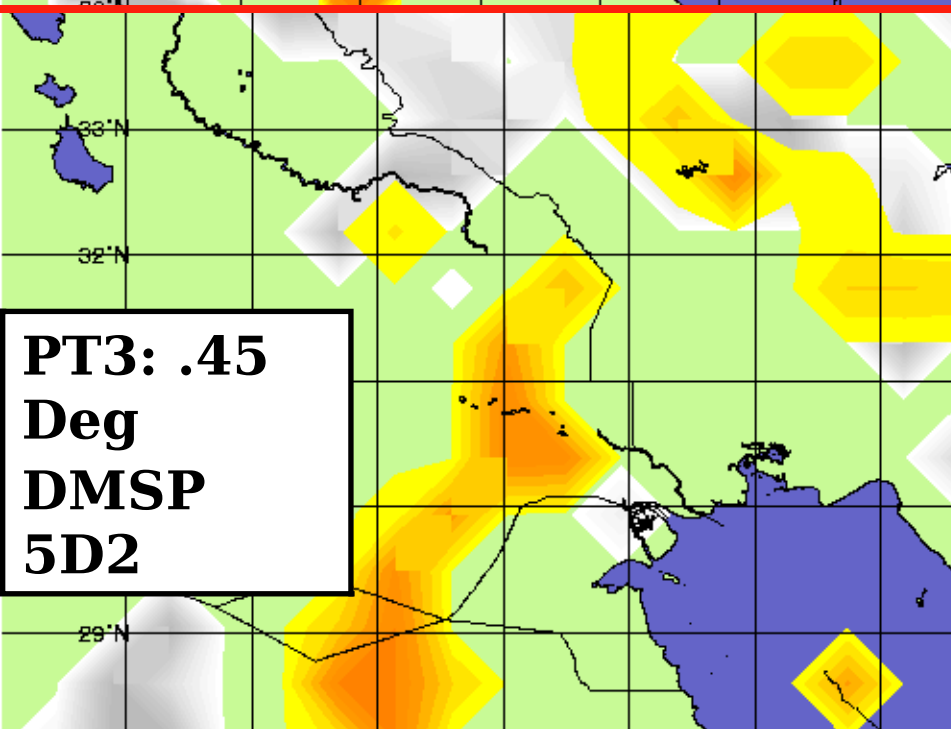
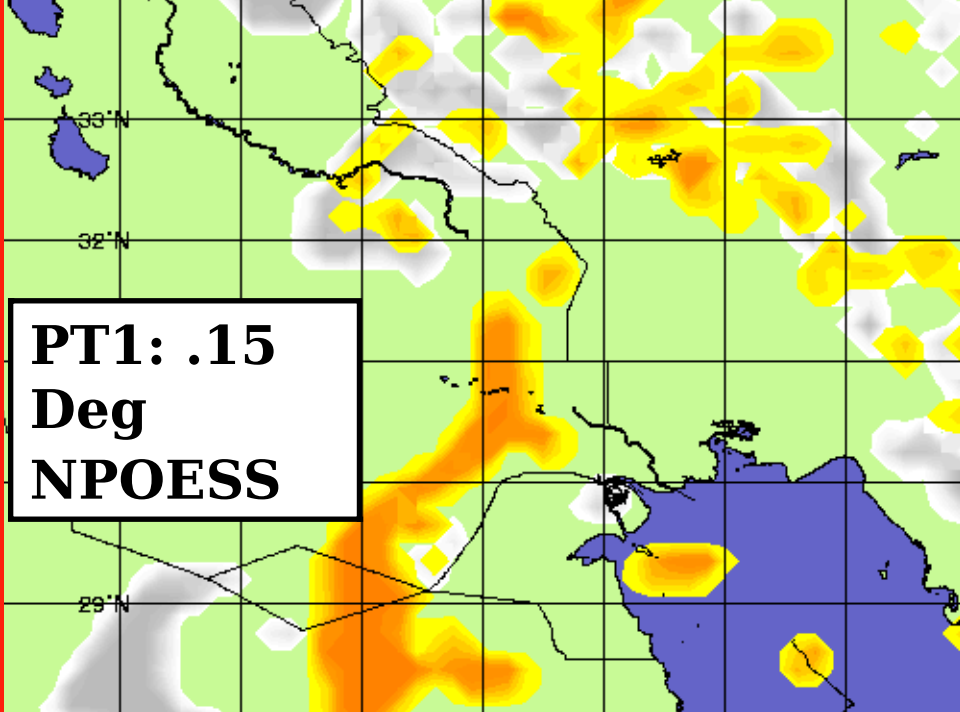
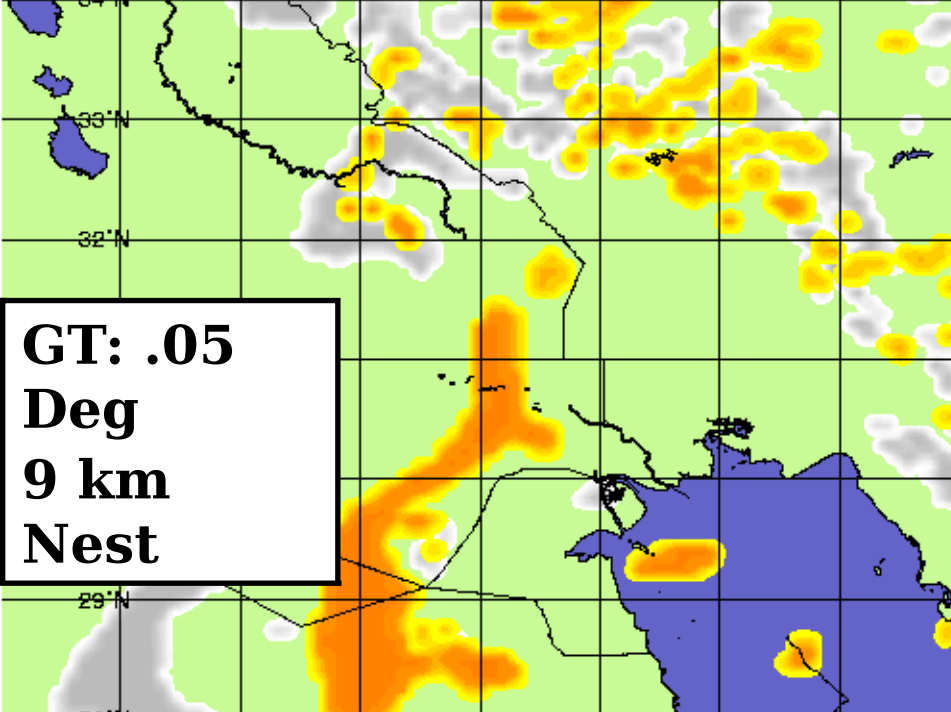
**Delivery Profiles supporting
Atmosphere, Oceanography,
and Space domains**

ESG Support to Space and Missile Center (SM

INEARP Based Support to SMC

SMC Request: Provide a two week Southwest Asia scenario with a full range of cloud coverage at four representations to support satellite-based sensor performance simulations.

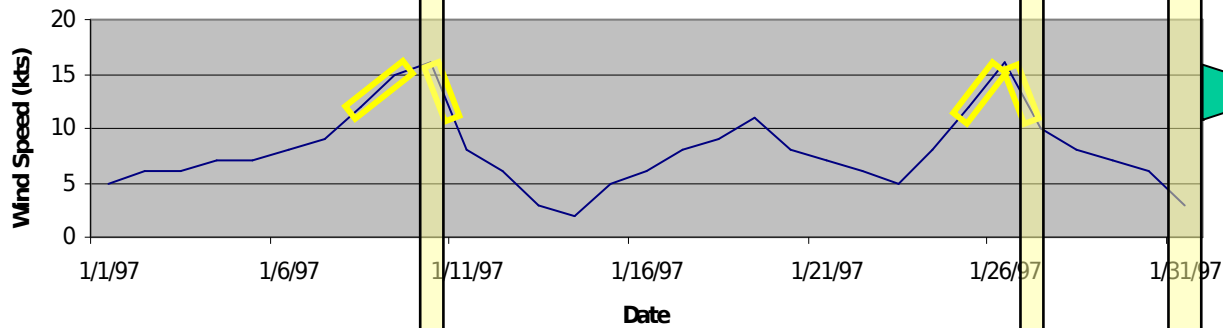
- **ASNE Subject Matter Expert determined 9 km resolution to yield the Authoritative Representation for stated SMC Requirements**
- **Run COAMPStm 81 / 27 / 9 km nests with NCEP/NCAR forcing to yield the AR data set. DISCARD the 81 and 27 km nests**
- **Using ESG's FDR-based utilities, interpolate the customer requested Ground Truth and Perceived Truth data to the 9 km resolution and then compare the AR data to the 9 km resolution data**



ESG Intelligent Search Capability

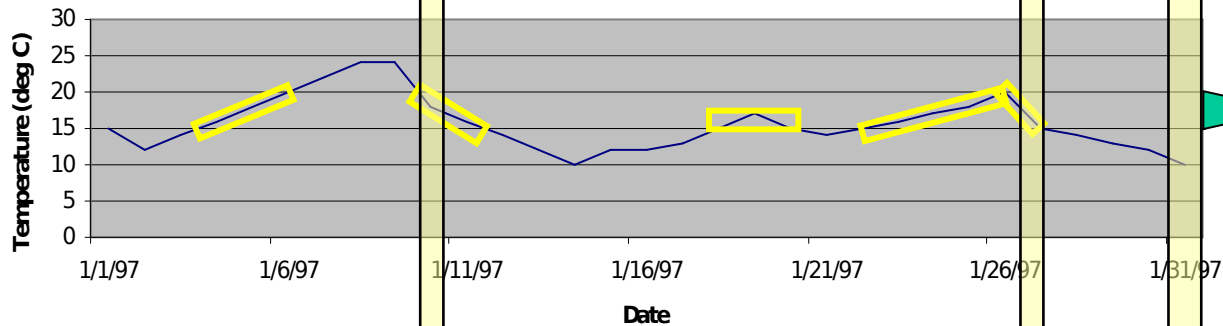
- **Locate events that will effect the warfighter simulation**
 - “Wet and Windy” in Korea
 - “Poor IR Performance” in SWAsia
 - “Winter Storm” in Med
 - All criteria translated into searches for specific environmental parameter conditions
- **Employs Fuzzy-Logic classification techniques**
 - Assignment of scores to each 4D (x,y,z,t) data point based on its proximity to desired condition
 - Supports more natural specification of criteria
 - “Very High Winds” instead of “Wind Speed > 20 m/s”
 - Built in realism for defined AOI and Season

January Wind Speed Record



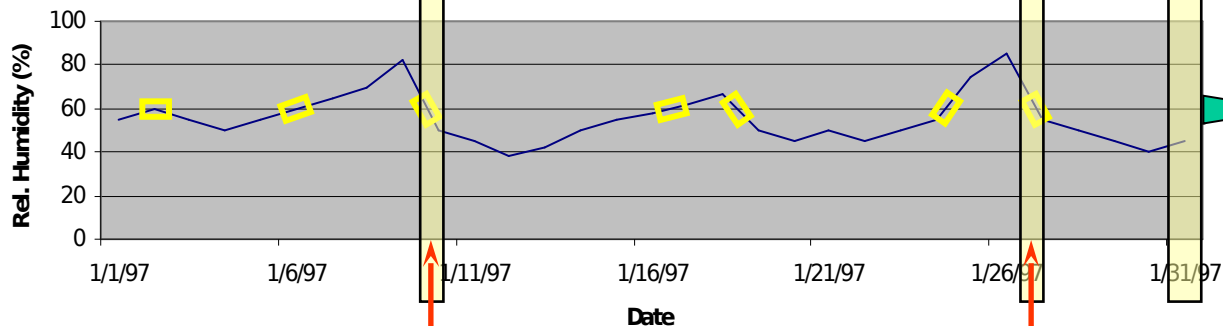
“High” Wind

January Temperature Record



“Average” Temperature

January Relative Humidity Record



“About” 60% Humidity

Searches for Military Effects

- **Integrate IWEDA / JTS Rules Database into ESG**
 - Supports Rule Selection by system/sub-system/component
 - Formulates ESG Fuzzy Query using the numeric rules
 - Each request translated to specific database parameters
 - Small parameter / rule sets leads to interactive analyses against multiple distributed resources
- **ESG Architecture provides flexibility in data source**
 - Source data's format and structure entirely hidden
 - Allows for on-the-fly translation of terminology and units
 - Allows for formal application of (distributed) transforms

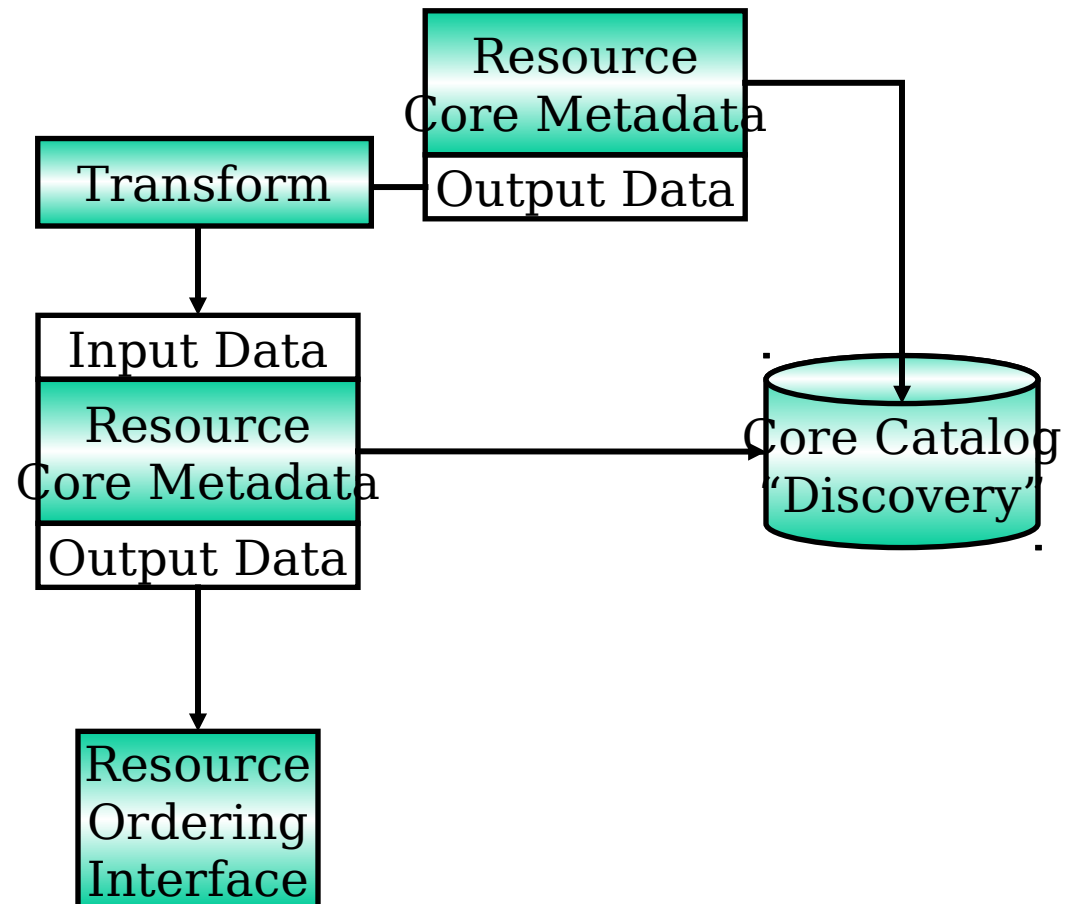
ESG Data Production Capability

- **Focused Support to the DoD M&S Community**
 - Unique consistency and representation requirements
 - Integration amongst multiple provider communities
 - Most resources “on the shelf” or “in the pipeline” do not meet the M&S content, structure, and/or format requirements
- **ESG Provides ...**
 - Consistent Metadata registration of both data and models
 - Specification of model inputs and application of transforms
 - Order architecture emphasizing “hands-on” integration of disparate resources (in contrast to MEL “hands-off” approach)
 - Process Control feature supporting resource dependencies
 - A Resource Site package to facilitate site communication and interfacing with local resources.

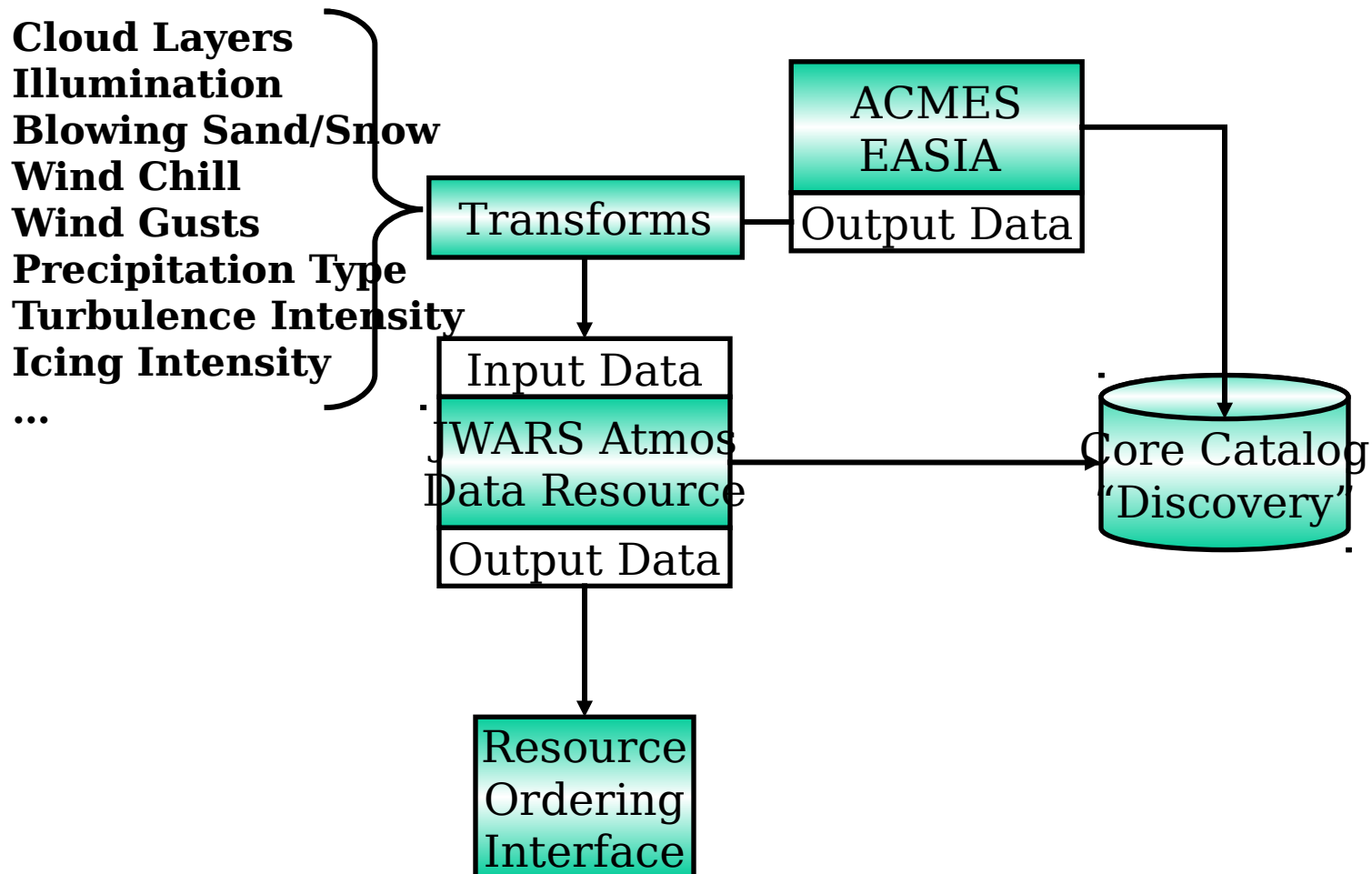
ESG Resource Ordering

- **Provide single point of access for resource orders**
 - Abstract location of resources
 - Facilitate accepted communication to resource site
 - Validate orders and user identity prior to submission
 - Manage the processing of orders involving multiple resources
- **ESG Resource Types**
 - A Resource delivers geospatial data
 - Data and Model Resources registered *identically*
 - Model resources simply include an input declaration
 - Virtual Resources are customer focused products that represent a sequence of real resource specifications, but does not exist itself.
 - Transforms are not registered and can not be ordered directly

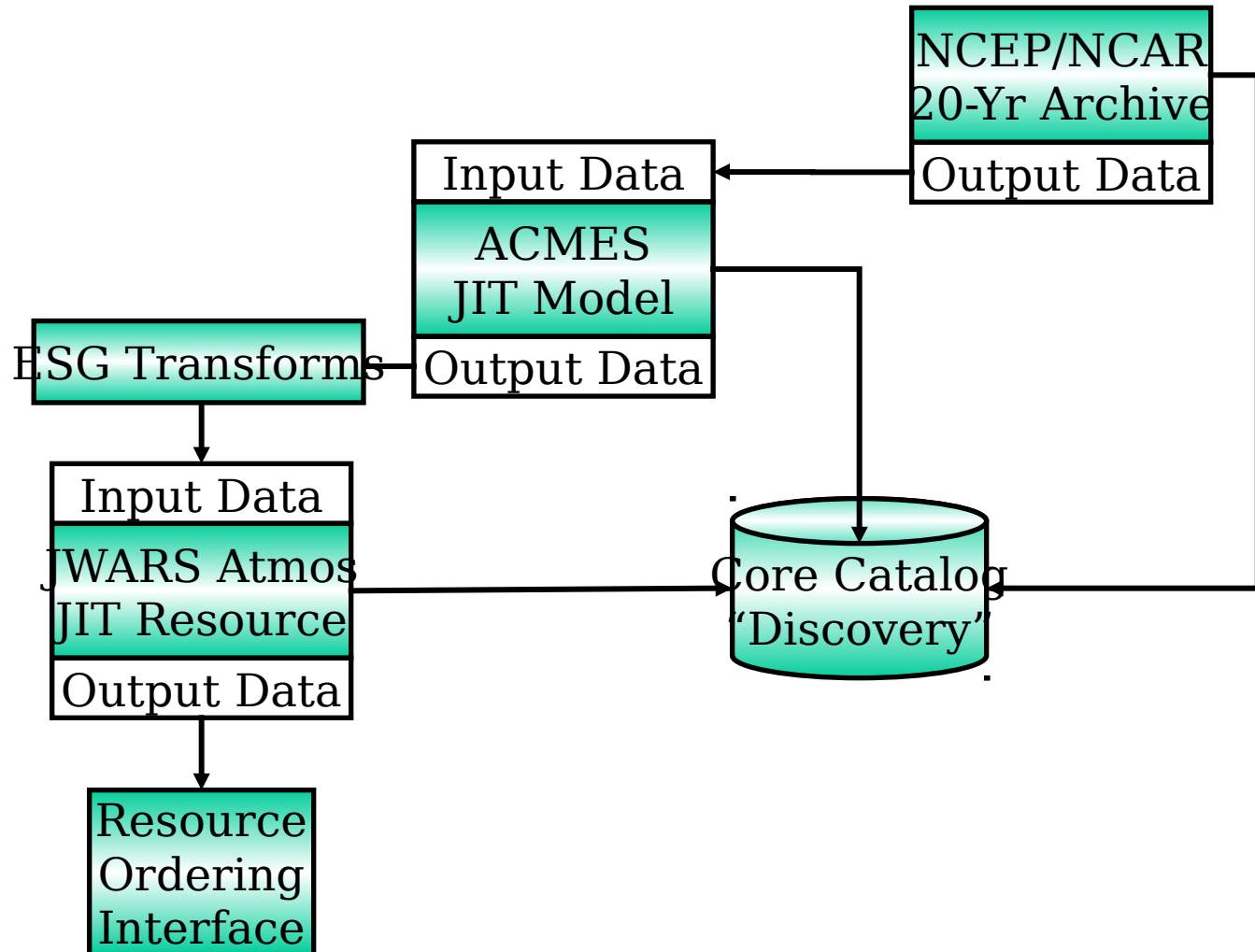
ESG Resources



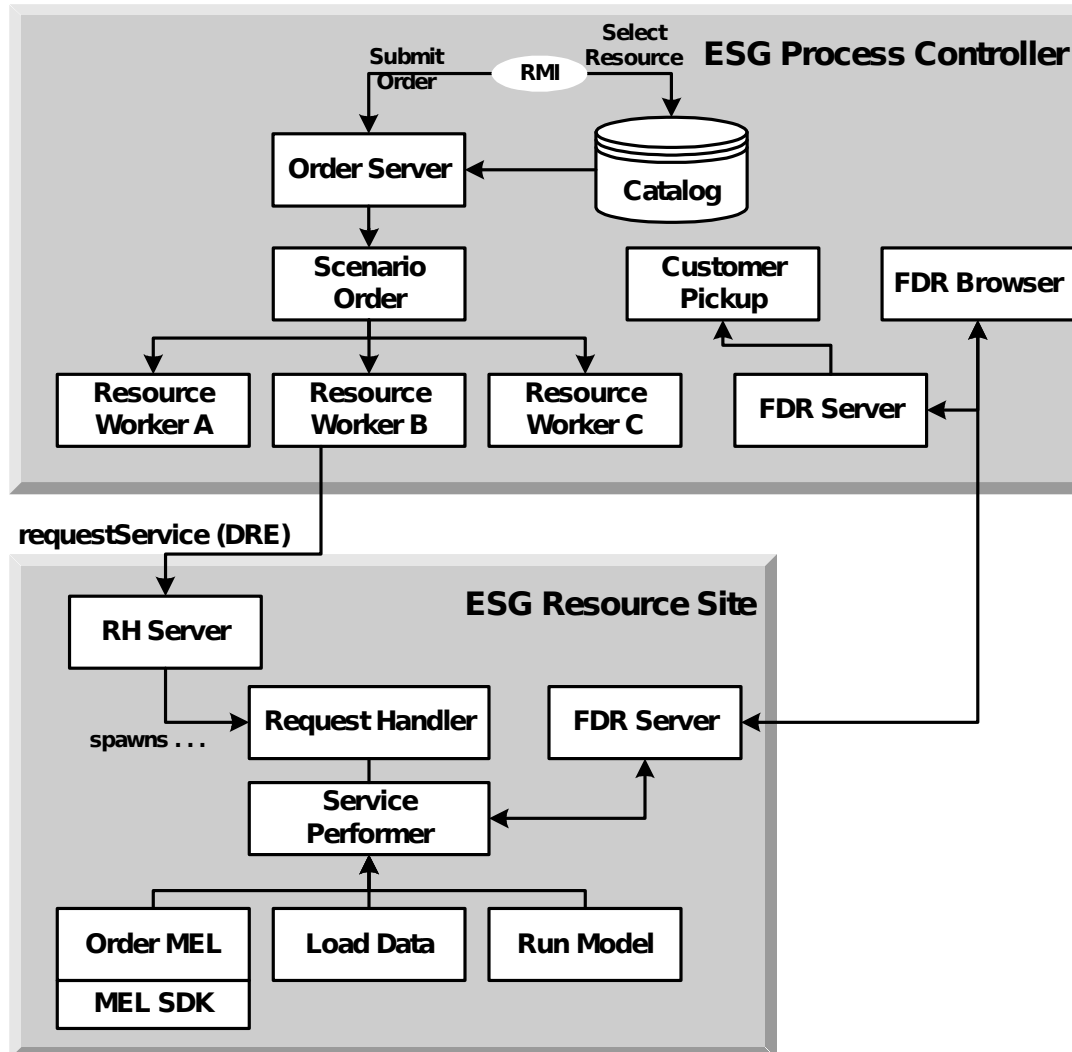
ESG Resources: Example 1



ESG Resources: Example 2

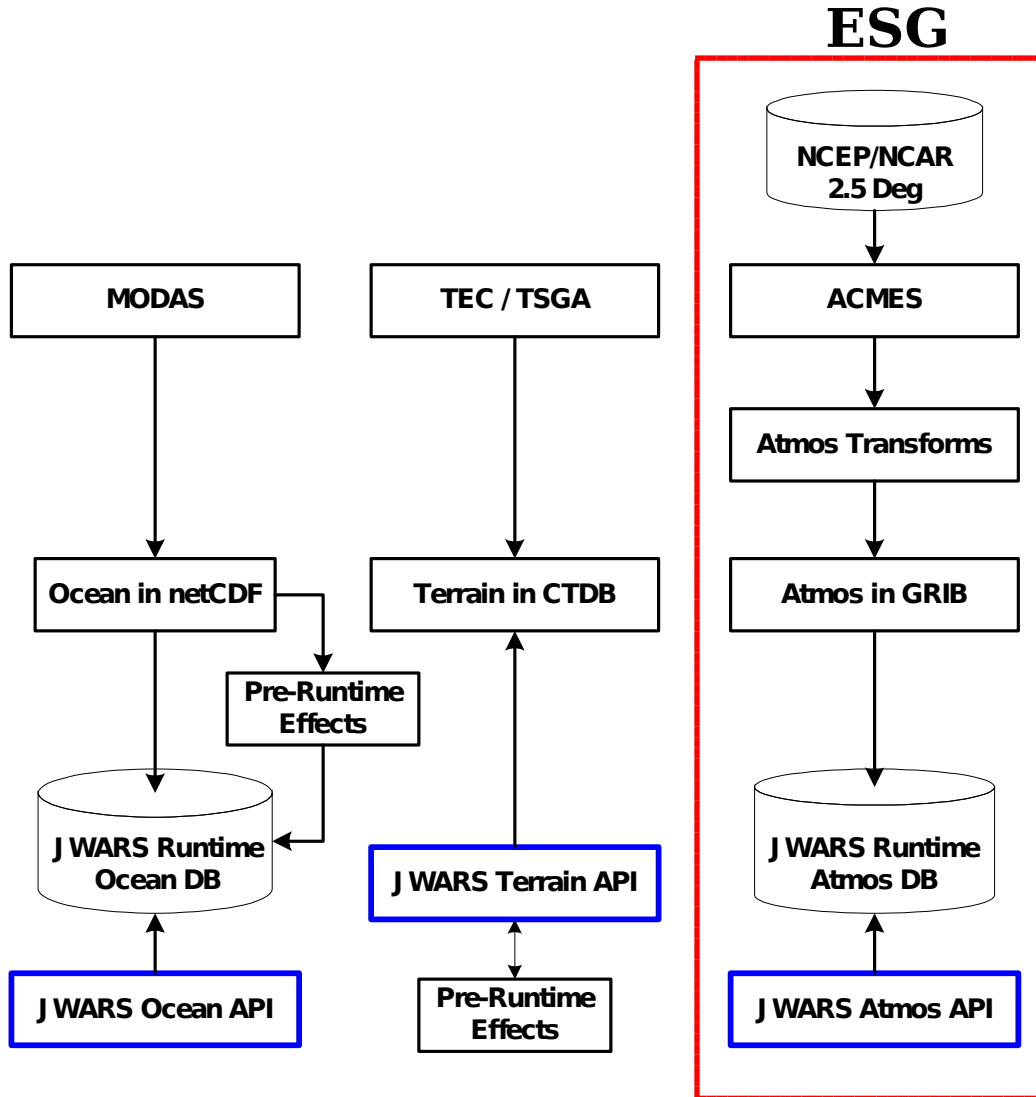


ESG Resource Ordering Architecture



ESG Support to Joint Warfare System (JWARS)

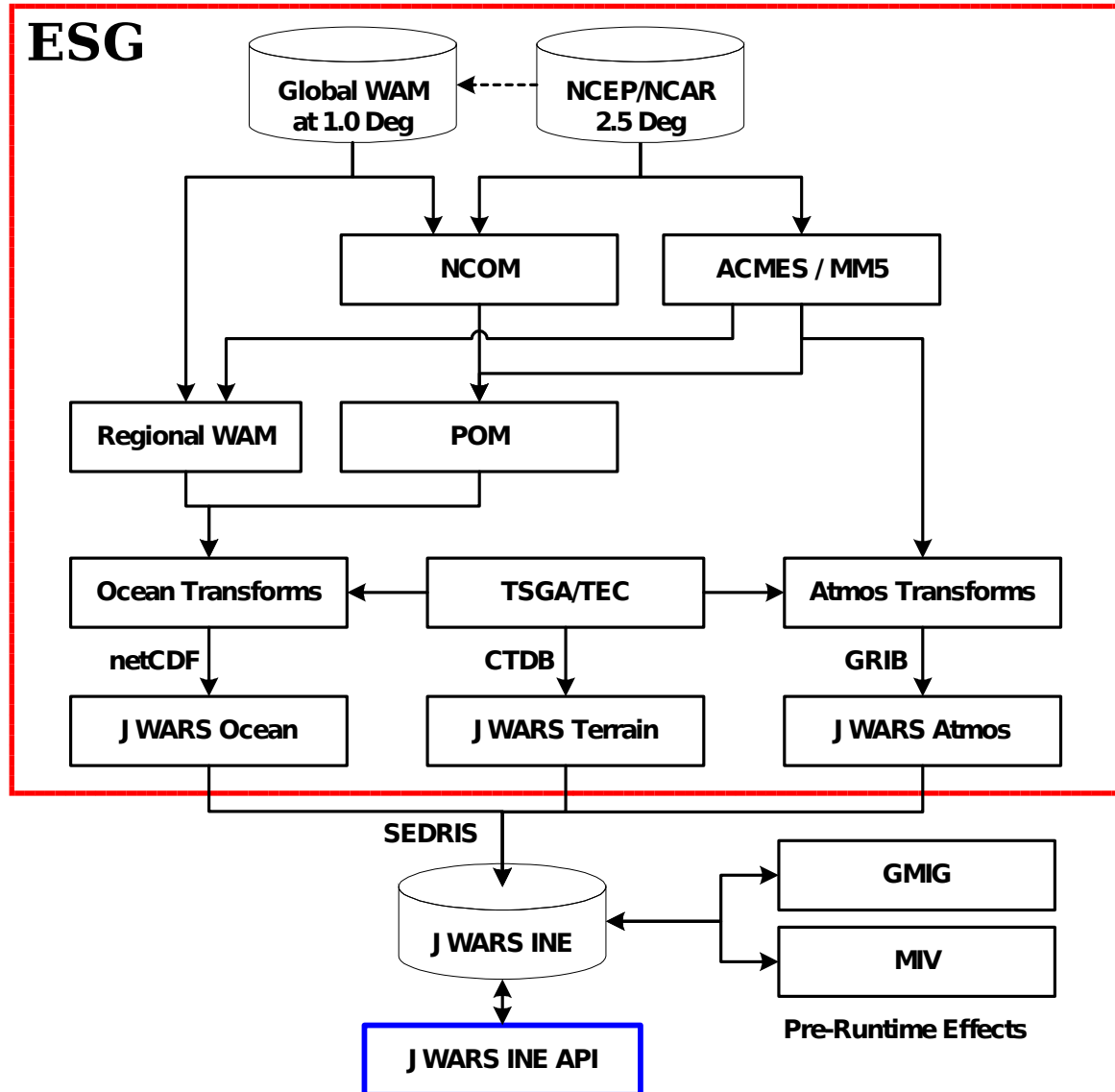
Current JWARS INE Production



ESG Process used to deliver four 18-month atmospheric databases:

- Southwest Asia
- East Asia
- South America
- Europe

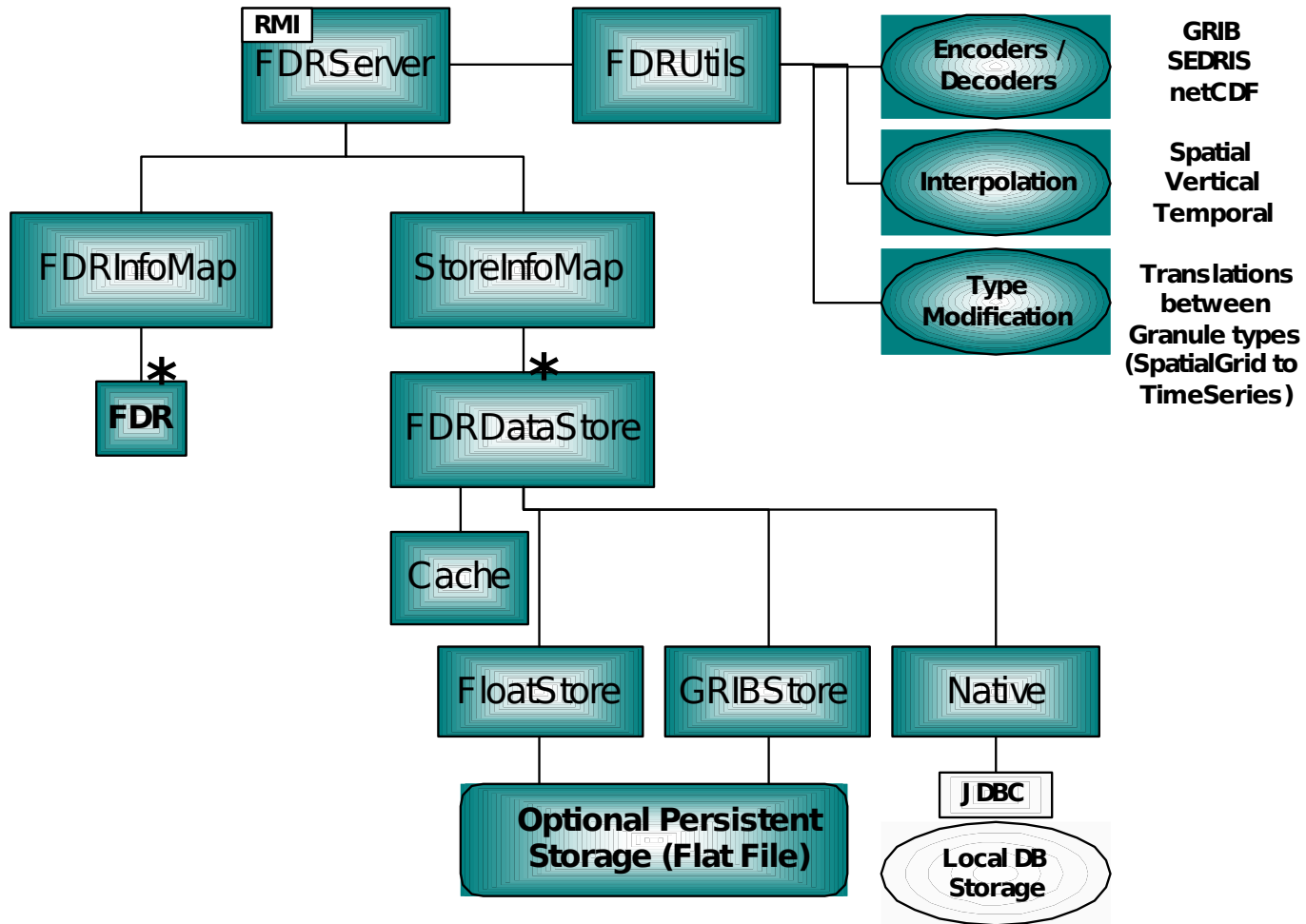
Future JWARS INE Production



FDR Server

- **Five Dimensional Representation (FDR) is a physical data model well suited for METOC data types.**
 - Currently support Spatial Grids, Time Series, Profiles, Points
 - In all cases, an FDR Data Set represents a 5D “data cube”
 - (x,y,z) Spatial Dimensions, Time, Parameter/Entity
 - Most API functionality consistent across all data types
 - Does not actually contain data, just its structural description!
- **FDR Server represents an ESG Application Data Server based on the FDR Data Model**
 - Provides an RMI Server focused on the management of FDR data objects, with the associated data located in Data Stores.
 - Provides many convenience functions to generate, manipulate, query, browse, and access FDR's and their data.

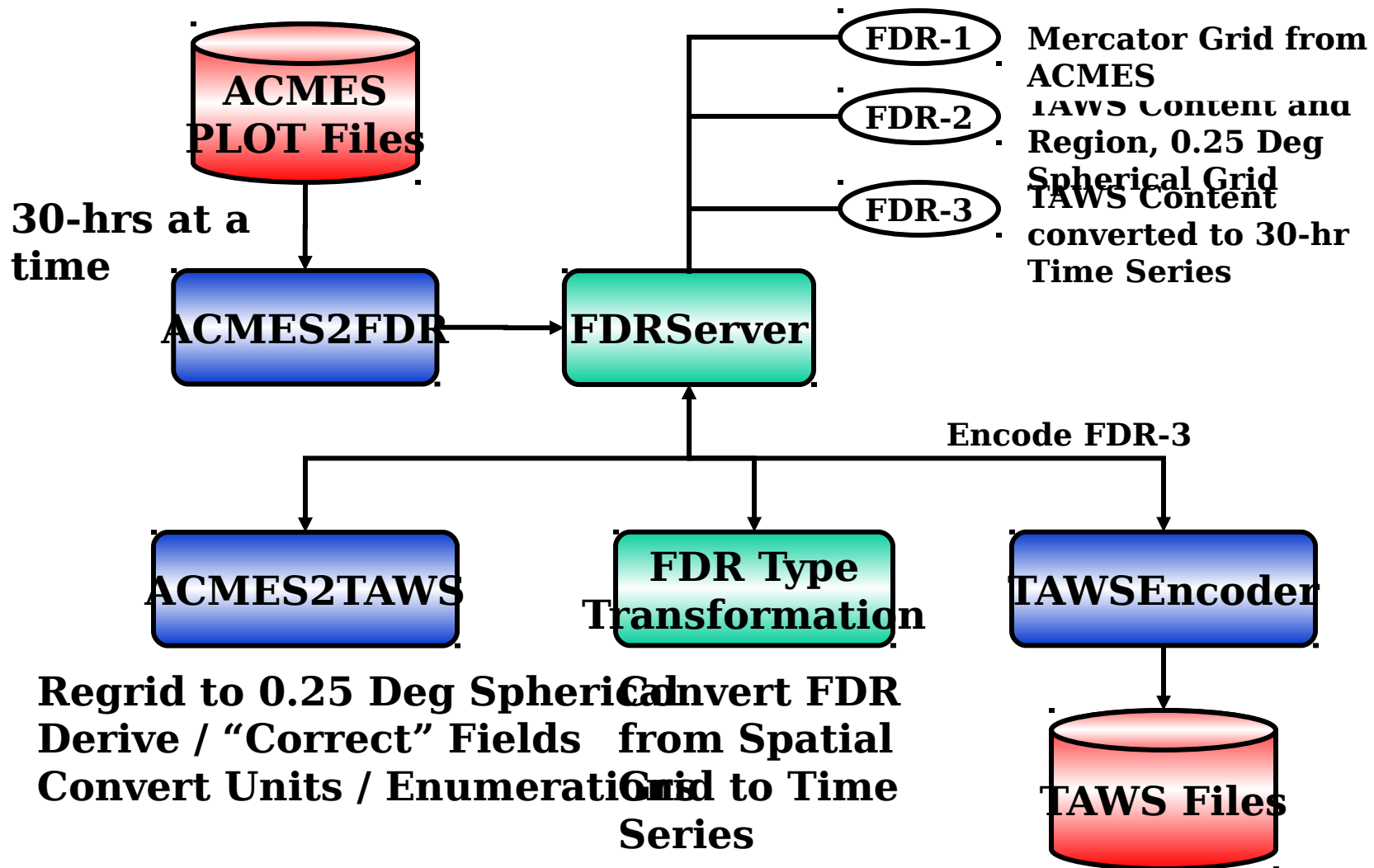
FDR Server Architecture



FDR-Based Utilities

- **Format Support**
 - GRIB Encoding / Decoding, including MMLite
 - SEDRIS Encoder
 - ACMES PLOT/DIAG File Decoding
 - COAMPS File Format Encoding / Decoding
 - MODAS/NCOM netCDF Decoder
 - HPAC Profile, TAWS met.dat formats supported
 - Working on FNMOC 4DCube DataBlade Encoder/Decoder
 - MySQL and Oracle Time Series Database interfaces
- **Generic Interpolation based on 3+ schemes**
 - Now applies to Spatial, Vertical, and Temporal
- **FDR Type Transformation Services**
 - Spatial Grids to Time Series, Points, Profiles

TAWS Processing from ACMES Data



Where are we going next?

- **B5.0 Infrastructure Components**

- Nearing completion, and fully integrated, CVS controlled
- Deployed to new server on ESGWEB at AFCCC
- Most tools are already updated to use the new B5.0 components

- **B5.0 Web Application**

- Migrate B4.1 functionality to B5.0 Infrastructure, using STRUTS
- Addition of new INEARP required user functionality
 - Projects to facilitate multiple work spaces and traceability
 - User Request Specification, with optional handoff to SME
 - AOI and Scenario Composition, Simulation Requirements
 - Delivery Specifications
 - Content, Format, and Delivery Requirements
 - Customer maintained resource lists for analysis / ordering
- Direct access to Resource Query, Browse, Order, Delivery functions

Some Final Thoughts

**ESG is *not* about
developing standards / Formats**

- **Historical Data Archives**
- **Environmental Models / Algorithms**
- **Military Simulations**

ESG is developing real application capability that leverages existing environmental data resources, standards, and tools to provide custom database solutions for the DoD M&S community.

P.S. Along the way, we are learning a LOT about standards, formats, data archives, environmental models, and military simulation.